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Infection of the Gulf Coast tick, *Amblyomma maculatum* (Acari: Ixodidae), with *Rickettsia parkeri*: first report from the State of Delaware

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Abstract

The molecular detection of *Rickettsia parkeri* in a Gulf Coast tick, *Amblyomma maculatum*, collected in Delaware represents the first evidence of the human pathogen *R. parkeri* associated with *A. maculatum* in the state. A total of five adult (2 male and 3 female) Gulf Coast ticks were collected from tick drags conducted during a two-day sampling event (21–22 May 2012) at Bombay Hook National Wildlife Refuge, near Smyrna, Delaware. All specimens were tested for the presence of *Rickettsia* with a genus-specific quantitative real-time polymerase chain reaction (qPCR) assay; one of the female specimens tested positive. This specimen was then assessed for the presence of *Rickettsia parkeri* and *Candidatus* Rickettsia andeanae by two species-specific qPCR assays. The presence of *R. parkeri* DNA was detected, whereas *Candidatus* R. andeanae DNA was not.

Key words: *Amblyomma maculatum*, *Rickettsia parkeri*, Delaware

Introduction

The Gulf Coast tick, *Amblyomma maculatum* Koch, has a range that extends from Peru to the southeastern United States, with a documented presence in many northeastern states, including New York, Connecticut and Maine (Teel *et al.* 2010). The occurrence of the species in these far northern states has generally been viewed as incidental dispersion; larval and/or nymphal stages are displaced from the Southeast when attached to migrating avian hosts. While the displaced immature stages may eventually molt into adults, the adult ticks do not complete a life cycle in these areas, probably because no stage is able to overwinter. Yet, the species does appear to be undergoing a range expansion from the past range boundary of South Carolina to the mid-Atlantic East Coast, as evidenced by large numbers of collected specimens, multiple collection sites, and multi-year data from North Carolina (Varela-Stokes *et al.* 2011) and Virginia (Wright *et al.* 2011, Formadel *et al.* 2011) that indicate established, viable populations in those states. In Delaware, the occurrence of *A. maculatum* has been documented only once (Lancaster 1973) in a listing that is suspected of being based upon incidental collection(s) – there is no evidence in the available literature that the species has been consistently found in the state during field collections or as an ectoparasite of animals/humans.

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Materials and methods

This report describes a single 2-day (21–22 May 2012) collecting trip to the Bombay Hook National Wildlife Refuge (NWR), near Smyrna, Delaware, where field drags were used to collect ticks. The single collection methodology and the extremely short collection period prevented determination of whether or not an established population of *A. maculatum* exists at the site. Instead, our goal was to collect any and all *A. maculatum* and test the collected specimens for the presence of *Rickettsia parkeri*, the causative agent of Tidewater spotted fever in humans (Jiang *et al.* 2012). The collection event was part of a larger effort to determine the geographical range of *R. parkeri* in the mid-Atlantic and New England regions. The time frame of mid May was selected to optimize the collection of adult *A. maculatum*. All collections were made within approximately 150 m of the GPS coordinates 39° 15' 47.8"N, 75° 28' 07.2"W, in a field of secondary growth near the entrance to the hiking trail leading to the Shearness Observation Tower. All specimens were immediately preserved in 100% ethanol and later transported to the Naval Medical Research Center, Silver Spring, MD, where processing of the ticks and molecular analysis were conducted. Laboratory materials and methods used have been previously published in Jiang *et al.* (2012).

Results and discussion

A total of five adult (2 male and 3 female) Gulf Coast ticks were collected at Bombay Hook NWR. Additionally, 55 specimens (21 adults, 34 nymphs) of *Amblyomma americanum* (Linnaeus) were collected, as were 13 adults of *Dermacentor variabilis* (Say). Molecular analyses for *R. parkeri* were conducted on *A. americanum* and *A. maculatum*, with all of the *A. americanum* testing negative.

Of the five *A. maculatum* specimens, a single female was positive for the *Rickettsia* genus-specific 17-kDa protein gene (*htrA*) (Ct value: 20.99) and subsequently was positive for the *Rickettsia parkeri*-specific qPCR assay (Ct value: 20.81; calculated *R. parkeri* genome copies in this tick: 1.69×10^8) but negative for the *Candidatus* R. andeanae-specific qPCR assay. We believe that this is the first time *R. parkeri* has been detected in Delaware within a collected tick specimen, thus adding to the U.S. geographic distribution of *R. parkeri* described in Sumner *et al.* (2007). It is noteworthy that a confirmed human case of *R. parkeri* infection was recently reported from Harford County, in northern Maryland, about 80 km from Bombay Hook NWR (Paddock *et al*. 2008). The next step is to determine whether there is an established population of *A. maculatum* at the Bombay Hook NWR and what percentage of the population is infected with *R. parkeri*, so that a robust epidemiological risk assessment can be developed.

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